

Table 4.1. Specific Impacts, Stressors, and Specific Management Goals

STRESSOR/ FACTOR	ISSUE [†]	SPECIFIC IMPACT	LOCATION	SPECIFIC GOALS
LAND USE	FM, R-FHM, WRM, OSP FM, R-FHM, WRM, OSP FM	<i>Removal of Riparian Vegetation Due to Development</i> <input type="checkbox"/> Increase bank erosion <input type="checkbox"/> Shade reduction <input type="checkbox"/> Fish food source impacts; reduction in cover and food	Throughout the watershed	<i>Preservation and Restoration of Riparian Habitat</i> <input type="checkbox"/> Preserve and revegetate riparian areas with native species <input type="checkbox"/> Establish buffer zones for no development or removal of riparian vegetation <input type="checkbox"/> Eradicate invasive, non-native species <input type="checkbox"/> Develop guidance for planners, developers, and permitting agencies regarding bank erosion, removal of riparian vegetation, and use of invasive non-native species <input type="checkbox"/> Maintain public lands/preserves as public/preserves; maintain easements and lease control <input type="checkbox"/> Preservation and management of Open Spaces <input type="checkbox"/> Allow floodplain flooding to occur <input type="checkbox"/> Restore floodplain area and habitat <input type="checkbox"/> Cattle fencing/crossings to minimize bank trampling <input type="checkbox"/> Signage and public education to minimize horse and OVR channel destruction
	FM, R-FHM, OSP, PEI	<input type="checkbox"/> Community/species diversity ○ Non-native invasive species ○ Change in local ecological community dynamics – change in dynamics of other non-native species competition with/predation of native species – shifting communities		
	R-FHM, OSP FM, R-FHM, WRM	<input type="checkbox"/> Non-contiguous habitat <input type="checkbox"/> Reduced filtration of pollutants and sediment		
	FM, R-FHM, OSP FM, R-FHM, OSP FM, R-FHM, WRM	<input type="checkbox"/> Overall reduction in habitat area <input type="checkbox"/> Increased edge effect <input type="checkbox"/> Increase in local ground water table/soil moisture (less plant uptake)		
	WRM, OSP, PEI	<i>Removal of Upland Native Vegetation Due to Development</i>		
	FM, WRM, OSP	<input type="checkbox"/> Increased surface erosion -> stream sedimentation		
	OSP, PEI	<input type="checkbox"/> Community/species diversity ○ Invasive non-native species ○ Change in local ecological community dynamics – change in dynamics of other non-native species competition with/predation of native species – shifting communities		
	OSP FM, WRM, OSP	<input type="checkbox"/> Non-contiguous habitat <input type="checkbox"/> Reduced filtration of pollutants and sediment		
				<i>Mapping (GIS)</i> <input type="checkbox"/> Create a current digital land use cover with attributes <input type="checkbox"/> Create a current digital cover of all plan areas and zoning/planned land use <input type="checkbox"/> Map canal system, ponds, reservoirs, siphons, aqueducts, channel elevation, and which are still in use <input type="checkbox"/> Digital map of impacted areas and extent: removed vegetation and

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	PEI	<i>Development in the Floodplain</i>	Secret Ravine, Miners Ravine	eroded areas <input type="checkbox"/> Locate all outfalls digitally
	FM, R-FHM, WRM, OSP, PEI	<input type="checkbox"/> Reduction in floodplain area and habitat		<i>In-Stream Management and Restoration</i>
	FM, R-FHM, WRM, DG	<input type="checkbox"/> Channelization and levees for flood control -> channel morphology changes		<input type="checkbox"/> Allow floodplain flooding to occur <input type="checkbox"/> Restore floodplain area
		<i>Increased Impervious Surfaces (amount and connectivity) Due to Development</i>		<i>Studies</i>
	FM, R-FHM, WRM	<input type="checkbox"/> Change in flow regime		<input type="checkbox"/> Determine which streams have changed from ephemeral to perennial
	FM, R-FHM, WRM	<input type="checkbox"/> Higher peak flow		<input type="checkbox"/> Assess outfalls for flow during storm events and or irrigation
	FM, R-FHM, WRM	<input type="checkbox"/> Faster timing of peak flow		<input type="checkbox"/> Measure water quality of WWTPs for nutrients
	FM, R-FHM, WRM	<input type="checkbox"/> More flow volume		<input type="checkbox"/> Determine impact of urban v. rural uses on water quality
	FM, R-FHM, WRM	<input type="checkbox"/> More surface runoff		<input type="checkbox"/> Sediment studies to determine extent of sediment toxicity problem
	FM, R-FHM, WRM	<input type="checkbox"/> Change in sedimentation and sediment transport		<input type="checkbox"/> Determine canal management practices (flows, timing, control)
		<input type="checkbox"/> Increased surface erosion		<input type="checkbox"/> Gage streams to determine actual flow and flow pattern
		<input type="checkbox"/> Increased bank erosion		
		<input type="checkbox"/> Increased scour of streambed		
	WRM, DG	<input type="checkbox"/> Reduction in localized flooding of developed area (street and sewer conveyance off-site)		
	PEI	<i>Nuisance and Augmented Flow (ephemeral changed to perennial; intermittent flow during dry season) Due to Development</i>	Strap Ravine?	<i>Preservation and Restoration of Upland Habitat</i>
	FM, R-FHM, WRM	<input type="checkbox"/> Canal management		<input type="checkbox"/> Encourage revegetation with native species
	FM, R-FHM, WRM	<input type="checkbox"/> Irrigation drainage (landscaped, agriculture)		<input type="checkbox"/> Eradicate invasive, non-native species
		<i>Agricultural Land Converted to Residential/Urban</i>		<input type="checkbox"/> Develop guidance for planners, developers, and permitting agencies regarding erosion and stormwater control and use of invasive non-native species.
	FM, WRM, DG	<input type="checkbox"/> Change in wastewater nature, amount, and location of outfall	Downstream WWTPs, Downstream outfalls	<input type="checkbox"/> Buy up easements and replant with native species
	FM, WRM	<input type="checkbox"/> Irrigation runoff and drainage from agriculture irrigation and runoff from urban		

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	FM, WRM FM, WRM, DG FM, WRM FM, WRM FM, WRM, R-FHM, DG FM, WRM, R-FHM, PEI FM, WRM, R-FHM, DG, PEI FM, WRM FM, WRM	<input type="checkbox"/> Change in amount of surface flow <input type="checkbox"/> Change in quality/pollutants Placer Mining (historic land use change) <input type="checkbox"/> Sedimentation (deposited tailings) <input type="checkbox"/> Water quality (deposited tailings) <input type="checkbox"/> Channel morphology modifications Bank Erosion <input type="checkbox"/> Agriculture <ul style="list-style-type: none"> ○ Grazing on bank ○ Trampling stream banks – unsupported crossings <input type="checkbox"/> Recreation <ul style="list-style-type: none"> ○ Off road vehicle crossings ○ Horse crossings Upland Topography And Water Storage Modifications <input type="checkbox"/> Infilling of low areas (including wetlands) <input type="checkbox"/> Changes in slope		Other <input type="checkbox"/> Public education regarding irrigation and drainage management <input type="checkbox"/> On-site detention: development does not change flow regime
WATER QUALITY	FM, WRM FM, WRM FM, WRM FM, WRM	Waste Water Treatment Plant Impacts <input type="checkbox"/> High conductivity <input type="checkbox"/> High nutrients? <input type="checkbox"/> Temperature effects Temperature Impaired <input type="checkbox"/> Summer impairment (too high for salmonids) <input type="checkbox"/> Winter impairment <input type="checkbox"/> Year round impairment <input type="checkbox"/> Other areas, times?	Lower Dry Creek Lower Dry Creek Lower Dry Creek, winter Generally all major tributaries except lower Secret Ravine Lower Dry Creek (below WWTP) Miners Ravine	Management Practices <input type="checkbox"/> Minimize discharge of surface runoff and associated pollutants <input type="checkbox"/> Prevent further degradation through requiring effective water quality BMPs on future development <input type="checkbox"/> Implement Integrated Pest Management Programs throughout the watershed Studies <input type="checkbox"/> Evaluate Roseville WWTP discharge for nutrient loads and impact on Dry Creek <input type="checkbox"/> Institute a long term monitoring study to determine trends and

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	FM, WRM	<i>Turbidity Impairment – can clog fish gills and affect escape predation due to visibility</i> <input type="checkbox"/> Winter <input type="checkbox"/> Yearly <input type="checkbox"/> Other areas, times?	All Upper Antelope, lower Secret Ravine, Linda Creek, lower Dry Creek	potential impacts of land use on water quality (include flow discharge measurements) <input type="checkbox"/> Institute first flush monitoring at several locations (first ones missed the actual first flush) <input type="checkbox"/> Analyze current and new data for trends (statistics) <input type="checkbox"/> Continue BMI studies as improvements are implemented for overall trends assessment (also select appropriate reference site) <input type="checkbox"/> Evaluate extent of sediment toxicity
	FM, WRM	<i>Conductivity – not impaired but high</i>	Linda Creek and lower Dry Creek below WWTP	
	FM, WRM	<i>pH Impaired</i> <input type="checkbox"/> Dec to June <input type="checkbox"/> Summer	Dry Creek Lower Antelope	<i>Mapping (GIS):</i> <input type="checkbox"/> Map all water quality/quantity monitoring sites
	FM, WRM	<i>Ammonia – not impaired but concern</i> <input type="checkbox"/> High in first flush <input type="checkbox"/> High in summer	All All	<i>Restoration:</i> <input type="checkbox"/> Assess areas for implementation of aeration mechanisms to enhance DO. <input type="checkbox"/> Restore shaded riparian habitat to lower stream temperatures <input type="checkbox"/> Others as necessary, depending upon studies <input type="checkbox"/> Establish riparian buffers to filter surface runoff prior to entry into streams
	FM, WRM	<i>Nutrients - impaired</i> <input type="checkbox"/> WWTP effect? (nitrogen, phosphorous) <input type="checkbox"/> First flush (nitrogen, phosphorous) <input type="checkbox"/> General <input type="checkbox"/> Other areas, timing?	Lower Dry Creek downstream of WWTP All Linda Creek, lower Dry Creek	
	FM, WRM	<i>BMI indicated impairment</i>	All	
	FM, WRM	<i>Pesticide Impairment</i> <input type="checkbox"/> Diazinon, Chlorpyrifos <input type="checkbox"/> No indications for others	Dry Creek, First Flush	
	FM, WRM	<i>Heavy Metals impairment</i> <input type="checkbox"/> Sediment? <input type="checkbox"/> Water column	Secret Ravine? Miners Ravine?	
	FM, WRM	<i>Sediment toxicity - general</i>	All?	

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FLOOD STORAGE AND CONVEYANCE	FM, R-FHM, WRM, DG, PEI	Barriers to Fish Passage <ul style="list-style-type: none"> <input type="checkbox"/> Trapped behind or above <input type="checkbox"/> Beaver dams <input type="checkbox"/> Human dams <input type="checkbox"/> Logs <input type="checkbox"/> Fences <input type="checkbox"/> Unscreened diversions <input type="checkbox"/> Canal flow modifications may lead to stranding <input type="checkbox"/> Sewer, water, and other infrastructure crossing stream beds <input type="checkbox"/> Culverts 		Engineering <ul style="list-style-type: none"> <input type="checkbox"/> Retrofit old bridges and culverts for fish passage and actual flood flow conveyance <input type="checkbox"/> Require new devices to meet design requirements for flow and fish passage <input type="checkbox"/> Retrofit old dams for fish passage <input type="checkbox"/> Screen all diversions <input type="checkbox"/> Survey all potential constrictions and measure/cross-check old model dimensions <input type="checkbox"/> Measure and cross-check old model in-stream cross-sections for input into flood model <input type="checkbox"/> Relocate sewer and water pipes that cross stream beds Operations and Management Practices <ul style="list-style-type: none"> <input type="checkbox"/> Develop a beaver management plan – document known dam locations <input type="checkbox"/> Remove fences within the floodplain <input type="checkbox"/> Excavate sediment from behind flow constrictions Restoration of Habitat <ul style="list-style-type: none"> <input type="checkbox"/> Restore floodplain area (amount) <input type="checkbox"/> Restore channel complexity – create meanders, riffle-run-pool habitat, add woody debris (must check hydraulics and make certain flood flows are still passed) <input type="checkbox"/> Device strategies to mitigate channelization <input type="checkbox"/> Buy up easements of land with structures on it that are within the floodplain
	FM, R-FHM, WRM, DG, PEI	Human Structures <ul style="list-style-type: none"> <input type="checkbox"/> Under-designed culverts and bridges -> flooding <input type="checkbox"/> Fences clogged with debris -> flooding <input type="checkbox"/> Sediment deposition right behind dams -> reduced storage volume, habitat destruction 		
	FM, R-FHM, WRM, DG	Channelization <ul style="list-style-type: none"> <input type="checkbox"/> Faster flow conveyance than natural (likely) <input type="checkbox"/> Under-designed for current flood flows <input type="checkbox"/> Reduction in floodplain area/storage <input type="checkbox"/> Sediment transport modifications – reduced deposition on floodplain <input type="checkbox"/> Destruction of channel complexity (habitat value) <input type="checkbox"/> Increased scour of bridges and non-channelized sections Beaver dams <ul style="list-style-type: none"> <input type="checkbox"/> More of the dams in streams and harder to control 		

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		<ul style="list-style-type: none"> ❑ Not designed for flood storage for human or geomorphological protection ❑ Sediment deposition right behind dams -> reduced storage volume, habitat destruction <p>Conveyance Maintenance</p> <ul style="list-style-type: none"> ❑ Cleaning debris -> destruction of habitat and protection ❑ Cleaning debris -> improved flood flow conveyance ❑ Faster flows -> bank erosion 		<p>floodplain</p> <p>Development BMPs</p> <ul style="list-style-type: none"> ❑ Add off-stream regional detention for reducing flood flow peaks and peak timing; no net changes ❑ Add additional BMPs/restore areas to bring hydrology back to 'normal' conditions where practicable ❑ Develop guidance for planners, developers, and builders regarding on-site flow detention and water quality BMPs <p>Mapping (GIS)</p> <ul style="list-style-type: none"> ❑ Map constrictions (road crossing, culverts), channelized areas, other flow restrictions <p>Studies</p> <ul style="list-style-type: none"> ❑ Measure flows and flow pattern (hydrograph) ❑ Update DCW Flood Control Manual models – check land use, culverts, crossings, constrictions, other ❑ Document locations of channelization
SURFACE WATER	<p>FM, R-FHM, WRM</p> <p>FM, R-FHM, WRM</p> <p>FM, R-FHM, WRM</p> <p>FM, R-FHM, WRM</p> <p>FM, R-FHM, WRM, DG</p> <p>FM, R-FHM, WRM</p> <p>FM, R-FHM, WRM, DG</p>	<p>Changes in Flow Regime</p> <ul style="list-style-type: none"> ❑ Higher flow -> bank erosion (worse if no riparian vegetation) ❑ Higher flow/flashier flow ❑ Change in depth of flow ❑ Channel incising from high flow -> lowering of shallow groundwater table ❑ Downstream flooding ❑ Ephemeral/intermittent -> perennial ❑ Canals and irrigation water withdrawals and discharge 	<p>Miners Ravine, Secret Ravine</p> <p>Strap Ravine, all?</p>	<p>Studies</p> <ul style="list-style-type: none"> ❑ Update Dry Creek Watershed Flood Control Plan model for current land use and projected ❑ Stream gauging to calibrate hydrologic and hydraulic model ❑ Stream gauging to determine actual flow hydrographs ❑ Stream gauging for stage-discharge relationships to determine pollutant loads when sampling for water quality

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	FM, R-FHM, WRM, DG FM, R-FHM, WRM, DG FM, R-FHM, WRM	<i>Waste Water Discharge</i> <ul style="list-style-type: none"> ❑ Flow augmentation in summer (dry season) ❑ Source from outside watershed (additions to local hydrology) <i>Agricultural and landscape drainage and runoff</i>		<ul style="list-style-type: none"> ❑ Analyze flow data (statistical) to determine chronic problems and trends ❑ Determine location of all outfalls and amount of flow ❑ Document eroded areas <i>Best Management Practices</i> <ul style="list-style-type: none"> ❑ Encourage water conservation ❑ Meter all water use ❑ Implement post construction BMPs for stormwater detention
POPULATION GROWTH	FM, WRM, DG FM, WRM, DG FM, R-FHM, WRM, OSP, DG FM, R-FHM, WRM, OSP, DG FM, WRM, DG WRM, DG FM, WRM, DG FM, WRM, DG FM, WRM, DG FM, WRM, OSP, DG FM, WRM, OSP, DG FM, WRM, DG	<i>Increased Development</i> <ul style="list-style-type: none"> ❑ Increased impervious surface area ❑ Increased impervious surface connectivity ❑ Reduction in riparian habitat and vegetation ❑ Changes in species communities and community dynamics (natives and non-native invasives) ❑ Increased flood control – e.g., more structures <i>Greater demand on water supply</i> <i>Increased wastewater generation -> discharge to surface water</i> <ul style="list-style-type: none"> ❑ Placer WWTP ❑ Roseville WWTP ❑ Additional facilities? <i>More recreation use</i> <ul style="list-style-type: none"> ❑ Increased trampling of banks and creek crossings by horses and off road vehicles ❑ Increased access? ❑ More parks? 	Miners Ravine Dry Creek ?	<i>Best Management Practices</i> <ul style="list-style-type: none"> ❑ Use ‘Smart Growth’ principles ❑ Institute water conservation practices ❑ On-site detention: no net changes in flow <i>Public Education</i> <ul style="list-style-type: none"> ❑ Educate public regarding good stewardship practices ❑ Encourage planting of native species ❑ Develop guidance for planners, developers, and permitting agencies, regarding bank erosion, removal of riparian vegetation, use of non-native invasive species, irrigation and drainage management ❑ Develop guidance for good stewardship practices and the role of individuals within the watershed.

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	OSP, DG	<input type="checkbox"/> More encroachment/inappropriate use of Open Space?		
GEOMORPH	FM, WRM FM, WRM FM, WRM FM, WRM FM FM, R-FHM, WRM FM, WRM FM, R-FHM RM, R-FHM, WRM RM, R-FHM, WRM FM, WRM FM, WRM FM, WRM FM FM, R-FHM FM, WRM	<i>Reduction in Channel Complexity</i> <input type="checkbox"/> Straightening <input type="checkbox"/> Removal of woody and other debris <input type="checkbox"/> Bank erosion <input type="checkbox"/> Changes in gradient <input type="checkbox"/> Reduction in riffle/run/pool habitat <i>Reduced floodplain area</i> <input type="checkbox"/> Increased depth of flow (levees, incising, dams) <input type="checkbox"/> In-stream sediment transport/deposition <input type="checkbox"/> Reduced floodplain habitat <i>Changes in Flow Regime</i> <input type="checkbox"/> Bank erosion <input type="checkbox"/> Sediment transport, scour, and deposition modifications <i>Channel Incising</i> <input type="checkbox"/> Placer mining <input type="checkbox"/> Higher flow <input type="checkbox"/> Channelization <i>Sedimentation</i> <input type="checkbox"/> Fill in of interstitial spaces; reduction in fish and BMI habitat <input type="checkbox"/> Placer mine tailings <input type="checkbox"/> Reduction in flow depth/storage volume	Dry Creek, Miners Ravine Throughout Strap Ravine, Secret Ravine Secret Ravine	<i>Restoration and Design</i> <input type="checkbox"/> Restore channel complexity <input type="checkbox"/> Reduce sedimentation <input type="checkbox"/> Restore floodplain <input type="checkbox"/> Design for both geomorphology and flood control
VEGETATION	OSM	<i>Removal of Non-Riparian Vegetation</i> <input type="checkbox"/> Reduction in ecological community diversity	Throughout the watershed	<i>Mapping (GIS)</i> <input type="checkbox"/> Map extent of invasive species: density, area, types <input type="checkbox"/> Map preserves, other Open Space,

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	OSM OSM OSM OSM OSM OSM	<input type="checkbox"/> Reduction in habitat contiguous area <input type="checkbox"/> Introduction of non-native invasive species <input type="checkbox"/> Reduced habitat area <input type="checkbox"/> Increased edge effect <input type="checkbox"/> Reduced habitat for special status species <input type="checkbox"/> Inadequate habitat for special status species		<p>and potential habitat</p> <p>Studies</p> <input type="checkbox"/> Assess all habitat for quality and restoration potential
				<p>Restoration</p> <input type="checkbox"/> Restore and revegetate areas with native plant species <input type="checkbox"/> Eradicate non-native invasive species <input type="checkbox"/> Preserve large contiguous corridors/areas <input type="checkbox"/> Preserve more open space <input type="checkbox"/> Develop Open Space Management plans for all areas, implement, and enforce them <input type="checkbox"/> Obtain grants for funding management plan implementation and enforcement (e.g., interest on grants in trust)
				<p>Education</p> <input type="checkbox"/> Prepare guidance for public regarding use of native plant species, identification of non-native invasive species, and appropriate BMPs for land surfaces/revegetation <input type="checkbox"/> Educate local nurseries on what plants they may have that are non-native invasive plants <input type="checkbox"/> Educate land owners regarding damaging grazing practices
				<p>Assemble and train volunteer groups and other local citizens on eradication of invasive non-native plants and revegetation with native plants</p>

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[†] Issues are identified as: FM = Fisheries Management, R-FHM = Riparian and Floodplain Management, WRM = Water Resources Management, DG = Development and Growth, OSM = Open Space Management, and PEI – Public Education and Involvement				
